Table 1

	Hard Coating	Oxidation Process		Deposition Process of Alumina Coating			Measurement Result of Alumina Coating		
		Substrate Temp.	Heating Time	Power	Number of sputtering sources used	Substrate Temp.	Film Thickness	I_α / I_γ	Crystal Structure
Inventive Case 1	TiAlN	780°C	20 min	3 kW	2	780°C	2 μm	γ -peak not detected*1	α -type
Comparative Case 1	TiAlN+CrN						2 μm	γ -peak not detected *1	α -type
Inventive Case 2	TiAlN	750°C	20 min	3 kW	1	770°C	1.15 μm	2.8	α -type: main, γ -type: sub
Inventive Case 3	TiAlCrN						1.15 μm	2.9	α -type: main γ -type: sub
Inventive Case 4	TiAlN	740°C	60 min	3 kW	1	770°C	0.9 μm	γ -type not detected*1	α -type
Comparative Case 2	TiAlN	635°C	20 min	3 kW	1	670°C	1.3 μm	1.4	Mix of α -type and γ -type
Comparative Case 3	TiAlN	580°C	20 min	3 kW	2	590°C	2 μm	α -type not detected *2	γ -type

*1: Peak of 2θ =19.4502°is not detected. *2 Peak of 2θ =25.5761°is not detected.

Table 2

	Hard Coating	Oxidation Process		Deposition Process of Alumina Coating			Measurement Result of Alumina Coating		
		Substrate Temp.	Heating Time	Substrate Temp.	Average Discharge Power (total of 2)	Deposition Time	Film Thickness	$I\alpha/I\gamma$	Crystal Structure
Inventive Case 1'	TiN	760°C	20 min	770°C	5.6 kW	3 hr	2 μm	γ-peak not detected*	α-type: main γ-type: sub
Inventive Case 2'	TiCN							γ-peak not detected*	α-type: main γ-type: sub
Reference Case	CrN							$I\alpha/I\gamma$=6.4	α-type: main γ-type: sub

* Peak of 2θ=19.4502°is not detected